APPENDIX B

NOTATION

Symbol	Unit	Definition
a	ft	wave amplitude
	ft	length of semimajor axis of elliptical-shaped tsunami generating area, equation (4-8)
	ft	horizontal distance from a vertical wall at the shoreline to a depth equal to twice the depth at the wall, equation (4-32)
	--	parameter in the JONSWAP spectrum, equations (5-15,16)
A	--	dimensionless amplitude of a resonant wave, equations (4-37,38)
	ft^2	total area of earthquake uplifting, equation (4-4)
A_b	ft^2	area of the harbor, equation (4-48)
A_{bc}	ft^2	cross-sectional area at the bay end of the harbor, equation (4-49)
A_c	ft^2	cross-sectional area of flow through the harbor entrance channel, equation (4-49)
A_i	ft^2	incremental area of earthquake uplifting, equation (4-3)
a_j	ft	amplitude of the j^{th} component of the energy spectrum, equation (5-1)
$A(K_1)$	ft	amplitude of tidal constituent K_1, equation (2-2)
$A(M_2)$	ft	amplitude of tidal constituent M_2, equation (2-2)
A_{ns}	ft	site-specific amplitude of tidal constituent n, equation (2-1)
A_o	--	dimensionless amplitude of resonant wave at the shoreline, equation (4-38)
$A(O_1)$	ft	amplitude of tidal constituent O_1, equation (2-2)
A_{sc}	ft^2	cross-sectional area at the sea end of the harbor, equation (4-49)
$A(S_2)$	ft	amplitude of tidal constituent S_2, equation (2-2)

a_x	ft/sec^2	horizontal water particle acceleration
a_z	ft/sec^2	vertical water particle acceleration
a_1	ft	amplitude of oscillation in the harbor
a_2	ft	amplitude of oscillation at the closed harbor entrance
b	--	parameter in the JONSWAP spectrum, equations (5-15,16)
	ft	length of semiminor axis of elliptical-shaped tsunami generating area, equation (4-8)
	ft	width of inlet entrance channel, equation (4-47)
B	Hz	resolution bandwidth parameter
	ft, km	mean inlet width, equation (4-44), Table 4-2
b_j	ft	distance between refracted wave rays at station j, equation (4-38)
B_j	$1/ft^2$	parameter, equation (4-38)
c	ft	maximum uplifted elevation of elliptical-shaped tsunami generating area at coordinates (x=0,y=0,z=0), equation (4-8)
C	ft/sec	wave celerity
	--	parameter, equation (4-38)
C_g	ft/sec	group wave celerity
C_1	ft/sec	Mach stem propagation speed, equation (4-42)
CPI	in Hg	central pressure index
c_R	--	coefficient of roughness and permeability
d	ft	still-water depth
	ft	average water depth over a fetch, equation (3-1)
	--	derivative, equations (4-37,48)
d_a	ft, km	mean depth of inlet, equation (4-43), Table 4-2
d_b	ft	water depth at wave breaking
D_f	km	earthquake focal depth, equation (4-1)
$D(f,\theta)$	--	angular spreading function, equation (5-27)

D_j	ft^2	parameter, equation (4-38)
d_s	ft	water depth at the toe of a nearshore slope, equation (4-41)
	ft	water depth at a vertical wall at the shoreline, equation (4-32)
d_1	ft	initial water depth
	ft	water depth at the seaward limit of a steep transition
d_2	ft	water depth under the transmitted wave
	ft	water depth at the seaward limit of the slope, equation (4-41)
e	--	constant = 2.71828..., natural logarithm base
E	ergs	earthquake energy, equation (4-2)
	ft-lbs	energy, equations (4-3,4)
E(f)	ft^2-sec	spectral energy density as a function of frequency, equation (5-15)
$E(f,\theta)$	ft^2-sec	spectral energy density as a function of frequency and direction, equation (5-27)
E_j	ft^2-sec	energy density in the j^{th} component of the energy spectrum, equation (5-2)
E_{pres}	ft^2-sec	energy at an underwater gage
e_s	--	standard error
E_{sfc}	ft^2-sec	energy at the surface
$E_{TMA}(f,d)$	ft^2-sec	energy density of TMA spectrum as a function of frequency and direction, equation (5-24)
exp(x)	--	e^x
f	Hz	wave frequency
F	miles	fetch length, equation (3-1)
	ft^2/sec^2	total bottom friction in a harbor entrance channel, equation (4-49)
f_{ny}	--	node factor of tidal constituent n for a specific year, equation (2-1)

	Hz	Nyquist frequency
f_p	Hz	frequency of the energy spectrum at which the energy density is highest
f_s	Hz	sampling frequency
g	ft/sec^2	gravitational acceleration
GCLWD	ft	Gulf Coast Low Water Datum
G(s)	--	function contained in the directional spreading function, equation (5-28)
h	--	nondimensional tide level, equation (2-8)
	ft	tsunami surge height, equation (4-50)
H	ft	wave height
	m	tsunami wave height, equation (4-5)
$\overline{H}$	--	scale parameter for Weibull distribution, equation (7-1)
$\hat{H}$	ft	particular value of H, equations (5-5,6)
$(h^2)_{avg}$	ft^2	average value of the square of the earthquake unlifted heights, equation (4-4)
h_b	ft	surface elevation of the water in a harbor above some arbitrary fixed datum, equations (4-48,49)
H_b	ft	wave height at wave breaking
h_c	--	specified normalized tide level, equation (2-8)
h_i	ft	height of earthquake uplifting over the incremental area A_i, equation (4-3)
H_i	ft	incident wave height
H/L	--	wave steepness
$(H/L)_c$	--	critical wave steepness for wave reflection, equations (4-28,29)
H_{mo}	ft	zero moment wave height
h_o	ft	height of the local MSL datum above the datum of reference, equation (2-1)
H'_o	ft	equivalent unrefracted deepwater significant wave height, equation (3-2)

H_r	ft	reflected wave height
H_{rms}	ft	root-mean-square wave height
h_s	ft	total wave height at shoreline, equation (4-51)
	ft	height of the sea level above an arbitrary datum, equation (4-49)
H_s	ft	significant wave height
$\bar{H}_s$	ft	mean significant wave height, equation (5-30)
$\hat{H}_s$	ft	particular value of H_s, equation (5-29)
$H_{s_{min}}$	ft	minimum (background) significant wave height, equations (5-29,30)
$(H_s)_{pres}$	ft	significant wave height at an underwater gage
$(H_s)_{sfc}$	ft	significant wave height at the surface
H_t	ft	transmitted wave height
H_v	ft	wave height given by visual observer
h_w	ft	seawall height, equation (4-51)
$h_{ys}(t)$	ft	tide at station s during year y at time t equation (2-1)
$H_{1/3}$	ft	average height of the one-third highest individual waves
$H_{1/10}$	ft	average height of the one-tenth highest individual waves
h_+ ,	--	tabulated tide limit immediately above h_c equation (2-8)
h_- ,	--	tabulated tide limit immediately below h_c equation (2-8)
I	--	relative intensity of secondary harbor undulations, equation (4-44)
I_g	ft	geometry integral, equation 4-49
IGLD	--	International Great Lakes Datum
k	1/ft	wave number
K_r	--	reflection coefficient, equation (4-24)
K_t	--	transmission coefficient, equation (4-23)

l	--	effective slope length, equations (4-26,27)
L	ft	wave length
	yr	prescribed time period in which a design wave is equalled or exceeded, equation (5-33)
L_b	ft, km	length of inlet, equation (4-43), Table 4-2
L_c	ft	length of inlet entrance channel, equation (4-47)
L_e	ft	effective inlet length, equation (4-45)
L_f	km	earthquake fault length, equation (4-6)
L_o	ft	resonant wavelength, equation (4-47)
L_p	ft	wavelength at peak frequency
l_s	ft	shelf width
m	--	beach slope, equation (3-5)
M	--	earthquake magnitude on Richter scale
MHHW	ft	mean higher high water
MHW	ft	mean high water
MLLW	ft	mean lower low water
MLW	ft	mean low water
MSL	ft	mean sea level
MTL	ft	mean tide level
N	--	number of intervals in the distribution function, equation (5-4)
	--	number of tidal constituents used in tide prediction equation, equation (2-1)
	--	dimensionless horizontal displacement of a water particle, equation (4-38)
	yr	average return interval of a storm event
NAVD	--	North American Vertical Datum
NGVD	--	National Geodetic Vertical Datum
nu	--	chi-square degrees of freedom

p	--	probability distribution function
P	--	cumulative distribution function
	--	probability of occurrence
P_e	--	encounter probability for a particular wave height, equation (5-33)
PMH	--	Probable Maximum Hurricane
P_n	in Hg	hurricane peripheral pressure
P_o	in Hg	hurricane central pressure
P_+	--	tabulated cummulative probability of the tide immediately above h_c , equation (2-8)
P_-	--	tabulated cummulative probability of the tide immediately below h_c , equation (2-8)
Q	ft^3/sec	flow rate through an entrance channel, equation (4-48)
q_n	ft^n	n^{th} moment of the distribution function of sea surface elevations, equation (5-4)
Q_p	--	spectral peakedness parameter, equation (5-3)
r	yr	time interval associated with each data point for calculated return period, equation (5-32)
R	--	type of tide (diurnal, semidurnal, or mixed)
	mi, nm	radius of maximum winds for a hurricane
	--	ratio of wind speed over water to wind speed over land
R_g	--	ratio of wind speed at 10-m level to geostrophic or free air wind speed
R_T	--	amplification ratio accounting for the effects of air-sea temperature difference on the wind speed
R_{33}	--	adjustment to correct wind speed to 33-ft level, equation (5-12)
s	--	constant-valued spreading parameter in the directional spreading function, equation (5-28)
S	--	beach slope, equation (4-22)
	ft	setup relative to the still-water level, equation (3-1)

S_b	ft	setup at the breaker line relative to the still-water level, equation (3-2)
S_j	ft^2	energy in the j^{th} component of the energy spectrum, equation (5-2)
SPH	--	Standard Project Hurricane
S_w	ft	wave setup at the mean shoreline, equation (3-4)
S_1	--	slope of the steep transition
S_2	--	slope of the shelf, equation (4-41)
S_3	--	nearshore slope
t	sec	time
	hr	time of predicted tide reckoned from some initial epoch, equation (2-1)
	hr	wind speed duration
T	sec	wave period
	min	tsunami period, equation (4-7)
	sec	resonant wave period, equations (4-40,41)
$\bar{T}$	sec	mean wave period, equation (4-45)
$\hat{T}$	sec	particular value of wave period
T_a	^oC	air temperature
T_f	hr	fetch-limited duration
T_{1e}	sec	effective-primary period, equation (4-45)
T_p	sec	significant or peak period
T_r	yr	return period of a particular wave height
	sec	record length
t_s	sec	time for a wave to travel the distance l_s
T_s	^oC	sea temperature
t_1	sec	the point in time when overtopping begins, equation (4-51)

T_1	sec, min	period of the first mode of wave oscillation, equation (4-35)
t_2	sec	the time when overtopping ends, equation (4-51)
T_2	sec	period of the second mode of wave oscillation, equation (4-36)
$T_{1/3}$	sec	average period of the highest one-third waves
u	ft/sec	horizontal velocity of a water particle in the direction of wave motion
U	mph	wind speed
U_C	mph	adjusted wind speed
U_f	mph	fastest-mile wind speed
U_g	m/sec	geostrophic wind speed
u_{max}	ft/sec	maximum horizontal velocity of a water particle in the direction of wave motion
U_L	mph	overland wind speed
U_w	mph	overwater wind speed
U_z	mph	wind speed at elevation z
U_{33}	mph	wind speed at 33-ft elevation
V	ft^3/ft	Volume of overtopping per ft of seawall at the shoreline
V_f	mph	speed of forward motion of a hurricane
w	ft/sec	vertical water particle velocity
x	--	horizontal Cartesian coordinate
	--	major axis of elliptical-shaped tsunami generating area, equation (4-8)
	--	independent variable, equation (G-1)
X_b	--	coordinate of the harbor end of the harbor entrance channel, equation (4-49)
X_s	--	coordinate of the seaward end of the harbor entrance channel, equation (4-49)
y	--	minor axis of elliptical-shaped tsunami generating area, equation (4-8)

	--	dependent variable, equation (G-1)
z	--	vertical Cartesian coordinate
Z	ft	distance above the water surface, equation (5-12)
Z_1	--	parameter defined in equation (4-22)
α	deg	angle between wave ray and a line normal to a tangent to the shoreline
	deg	hurricane inflow angle
	--	parameter in JONSWAP spectrum
β	rad, deg	angle of beach slope
γ	--	peak enhancement parameter in JONSWAP spectrum, equations (5-15,19,22)
	--	shape parameter in Wiebull distribution, equation (7-1)
Δ	ft	horizontal distance between stations j and j+1 for calculating resonant wave amplitude, equation (4-38)
Δf	Hz	frequency increment
$(\Delta f)_j$	Hz	frequency bandwidth of the j^{th} component of the energy spectrum, equation (5-2)
Δs	ft	total difference in water surface elevation between the breaker line and the mean shoreline, equation (3-3)
Δt	sec	sampling interval
	hr	time-step in numerical model, Figure 5-58
Δx	mi	grid spacing in numerical model, Figure 5-58
ζ	ft	vertical water particle displacement
ε	--	significant wave steepness, equation (5-23)
η	ft	water surface elevation above the undisturbed surface
θ	rad	direction in directional spectral model, equation (5-27)
	deg	hurricane track angle
θ_o	deg	mean wind direction, equation (5-28)
θ_1	deg	incident wave angle, equations (4-18,19,20)

θ_2	deg	transmitted wave angle, equations (4-18,19,21)
κ	--	parameter in JONSWAP spectrum, equations (5-18,19,20)
κ_{ns}	deg	phase lag or epoch of tidal constituent n for specific site, equation (2-1)
λ_3	ft^3	skewness, third moment of the sea surface elevation
λ_4	ft^4	kurtosis, fourth moment of the sea surface elevation
ν_{ny}	--	equilibrium argument for tide prediction equation, equation (2-1)
ξ	ft	horizontal displacement of the water particle from its undisturbed position, equation (4-12)
ξ_{max}	ft	maximum value of ξ , equations (4-14,17)
π	--	constant = 3.14159...
ρ	$slugs/ft^3$	water density
	--	distance offshore divided by the distance from a vertical wall to a depth equal to twice the depth at the wall, equation (4-37)
σ	--	parameter in JONSWAP specturm
σ_{H_s}	ft	standard deviation of significant wave heights, equation (5-29)
σ_n	deg/hr	frequency or angular speed of tidal constituent n , equation (2-1)
$\phi(2\pi f,d)$	--	function in TMA spectrum to account for water depth, equations (5-24,25)
ϕ_j	rad	phase of the j^{th} component of the energy spectrum, equation (5-1)
ψ_1,ψ_2	--	wave radiation frequencies, equation (4-46)
ω	rad/sec	angular frequency, equation (4-38)
ω_d	--	parameter to approximate $\phi(2\pi f,d)$, equation (5-25)
ω_j	rad/sec	angular frequency of the j^{th} component of the energy spectrum, equation (5-1)
∂	--	partial derivative, equation (4-33)
∞	--	infinity